

Grade 4 Rocks and Minerals: *Culminating Activity*

Overview

This culminating activity is designed for use in the Grade 4 Rocks and Minerals strand. The project consists of a cooperative group work component where students will be analysing rock samples from the local area around their school and home. The second part of the project involves writing a persuasive letter to the local City Councillor in favour of or opposed to a proposed mining site next to the school.

Timing

This culminating activity will require three 40 minute periods to complete and should be done at the end of a unit on Rocks and Minerals.

Assessment

There are three assessment components to the culminating activity. Students will be assessed on their rock analysis sheets, which are completed within their groups. There is also a rubric for assessing their persuasive letter, as well as a self assessment of their contribution to the group work.

Curriculum Expectations

STSE

- 1.2 analyse the impact on society and the environment of extracting and refining rocks and minerals for human use, taking different perspectives into account.

Investigation

- 2.1 follow established safety procedures for outdoor activities and for working with tools, materials, and equipment.
- 2.3 use a variety of criteria to classify common rocks and minerals according to their characteristics.

Communication

- 2.5 use appropriate science and technology vocabulary, including hardness, colour, lustre, and texture, in oral and written communication.
- 2.6 use a variety of forms to communicate with different audiences and for a variety of purposes.

Knowledge

- 3.3 describe how igneous, sedimentary, and metamorphic rocks are formed.
- 3.4 describe the characteristics of the three classes of rocks.

Part A: Student Handout

Learning Goals:

The goal of this assignment is to use what we have learned in class about rocks and minerals and study the rocks found in our local community. We will also try to imagine what it would be like to live next to a rock quarry and how the quarry would affect us and the community.

Scenario: The Rock Quarry

The Rocks-R-Us company wants to build a rock quarry next to the school and has applied to the city of Toronto for a permit to go ahead with the construction. Since our class will be studying rocks and minerals in science class the city has decided to consult with us to help them decide whether or not the permit should be granted.

As an official rocks and minerals expert your task is two-fold:

1. To gather sample rocks from around the school or home, analyse them and together with a group of your classmates complete a Rock Information Sheet for each of the rocks. Your collection of rocks will be sorted and organized for presentation based on their common characteristics.
2. The rock collection analysis will be accompanied by a persuasive letter to the City Councillor stating your opinion as to whether the permit to build the rock quarry should be granted or not. The letter will provide at least 3 reasons to back up your decision and should be based on our class discussions on the pros and cons of mining.



Assessment:

You will be assessed on the following:

- Completed Rock Information Sheets (20 marks)
- Self assessment of group work and participation (10 marks)
- Final letter to City Councillor (20 marks)

Total = 50 marks



Timeline:

- **Day 1:** Each student should *bring in 2 rocks* found from around the school or where you live. Remember the safety rules for collecting rocks and do not take rocks from other people's properties. In *groups of 4 or 5* you will complete a Rock Information Sheet for each rock sample brought in.
- **Day 2:** Your group will be given supplies to organize and create a display for your group's rock collection. Your collection of rocks will be sorted and organized for presentation based on common characteristics as decided by the group. You will also be required to complete a self assessment of your participation within your group.
- **Day 3:** Each student will complete the letter writing graphic organizer stating whether they are for or against the proposed rock quarry next to the school. The reasons to support your decision should take into account our class discussions on the pros and cons of mining. After completing the graphic organizer have a classmate complete the checklist portion of the graphic organizer.
- **Day 4:** Each student will take the information from the graphic organizer and compose a final letter to the City Councillor.

Prior Knowledge and Skills Required

- Students are asked to bring in 2 rocks from around the school or where they live. For this they should have knowledge of the safety rules and guidelines for collecting rocks outside.
- For completion of the Rock Information Sheet the students need to have been taught about rock description terminology and tests such as the scratch test. They also need to have knowledge of the rock cycle and how to classify a rock as sedimentary, igneous or metamorphic. Lastly, they need to know about possible uses for rocks.
- For effective group work the students should also be reminded or taught group work rules and skills.
- For completion of the letter writing portion of the assignment the students should have knowledge of letter writing technique including the different parts of a letter.
- In order to justify an opinion as to whether the rock quarry should be built or not the students need a knowledge of the pros and cons of mining. This includes the effects of mining on the environment and local community as well as the necessity of mining in obtaining the raw materials for products we use.

Unit Overview

Period 1: *Introduction to Rocks and Minerals*

- Read a picture book on rocks. I would suggest 'Everybody Needs a Rock' by Byrd Baylor as a good way to introduce rock collecting rules.
- Introduce the culminating activity and then do a KWL on what we will need to know to complete the assignment (eg. what are important things to know about rocks as well as quarries/mines).

Period 2: *Uses for Rocks and Minerals*

- Discuss the difference between a rock and a mineral. Start discussion on what the students know about the uses for rocks and minerals.
- Have pictures on the board to be grouped into "things that are made from rocks or minerals" and "things that are not made from rocks and minerals" and have the students move the items into the category they think fits. For example, you could use: cement (limestone), nails (iron from magnetite and hematite), salt (halite), glass (quartz), penny (zinc), diamond ring (diamond and metal), candle, paper, socks, plastic spoon, apple.
- In groups complete a worksheet asking them to find 10 things around the class that could be made from rocks and minerals. Come together to discuss the answers.

Period 3 and 4: *Mining and Quarrying*

- Have the students read about mining and quarrying to see where the rocks and minerals that are used to make things come from. After, start a discussion on the pros and cons of mining, highlighting the effects of mining on the environment and local community as well as the necessity of mining in obtaining the raw materials for products we use.

- In groups, students will represent one point of view with regards to an existing mine (a gold mine on First Nations land in northern Ontario). The four views are: mining company, miners, environmentalists, and indigenous people living in the area. Each group will discuss their view on the mine and then make a poster with a statement or slogan either supporting the mine or not. Students will present their posters to the class.

Period 5: *The Rock Cycle*

- Use the interactive website: <http://www.learner.org/interactives/rockcycle/index.html> to go over the rock cycle. From this activity the students should learn how igneous, sedimentary and metamorphic rocks are formed as well as identifying features of each.
- Introduce the Rock Classification Key (see appendix) and demonstrate how to classify a number of rocks using the key.

Period 6: *Describing Rocks and Minerals*

- Use examples of rocks and minerals to go over characteristics of rocks and minerals including size, colour, lustre, and presence of layers or crystals. Discuss the Mohs hardness scale for minerals and demonstrate the scratch test and the streak test if possible.

Period 7 to 10: *Culminating Activity*

Culminating Activity Implementation Plan

Period 7: *Completion of Rock Information Sheets*

- Assign groups with 4 or 5 students per group. Each group should have at least 2 rocks per student that they have brought in.
- Hand out the Rock Information Sheets and Rock Classification Key to each group. Each group will also receive a penny, a glass rod, and an iron nail for the scratch test, as well as a magnifying glass if available.
- Instruct students that they must fill out one Rock Information Sheet for each of their rocks. Go over safety rules for the scratch test implements.
- Have students check the completed Information Sheets of their group members to ensure they have been filled out completely and accurately (display and potentially go over a completed Information Sheet exemplar for them to refer to)

Materials: Rock Information Sheets and Rock Classification Keys (see appendix); completed Information Sheet exemplar; scratch test implements for each group (pennies, glass rods, iron nails); rulers for measurement; magnifying glasses if available. You can consider bringing in extra rocks for the students that forget to bring them in.

Reminders: Tell the students about bringing in rocks for this task a few classes before and remind them in the days leading up to it. Go over the rock collecting rules and safety considerations.

Assessment: The students will be given a mark (out of 20 suggested) for their completed Rock Information Sheets. These will be handed in to be marked after completion of rock collection display (Period 8).

Curriculum expectations addressed: 2.1 follow established safety procedures for outdoor activities and for working with tools, materials, and equipment. 2.3 use a variety of criteria to classify common rocks and minerals according to their characteristics. 2.5 use appropriate science and technology vocabulary, including hardness, colour, lustre, and texture, in oral and written communication. 3.3 describe how igneous, sedimentary, and metamorphic rocks are formed. 3.4 describe the characteristics of the three classes of rocks.

Period 8: Rock Collection Display

- Provide materials to each group for creating their display. Also hand out the self assessment sheets.
- Instruct the students that in their groups they will organize and create a display for their group's rock collection. Each group will choose one characteristic (e.g. colour, hardness, rock classification, etc.) by which to sort and organize their collection. The characteristic they choose must be related to how they envision the rocks being potentially used by the Rocks-R-Us company.
- After completion of the display each group member will complete a self assessment sheet which also asks them to explain their choice for sorting characteristic as it relates to the use they envision for the rocks. For example, colour, size and hardness could all be justified by use in construction materials, and rock classification could be justified by the fact that similar rock types may have similar minerals in them.

Materials: Poster paper, markers, scissors, glue, and any other materials for making the displays; Self assessment sheets (see appendix).

Assessment: The students will be given a mark (out of 10 suggested) for their completed self assessment sheet. The sheet also asks them to write down how their group sorted their rock collection and explain why this was chosen.

Curriculum expectations addressed: 2.3 use a variety of criteria to classify common rocks and minerals according to their characteristics. 2.5 use appropriate science and technology vocabulary, including hardness, colour, lustre, and texture, in oral and written communication.

Period 9: Completion of Persuasive Letter Writing Graphic Organizer

- Hand out the letter writing graphic organizer.
- Instruct students to decide on a position to take on whether the city should grant the Rocks-R-Us company a permit to build the rock quarry next to the school. In their decision they should recall the pros and cons of mining/quarrying as discussed in class. Some of the considerations could include the effects on the environment and local community as well as how the rocks from the quarry could be potentially used.
- Provide time to complete the graphic organizer and then have the students exchange with a classmate to have them fill out the check list at the bottom of the sheet.
- Provide the option of having the students hand in the graphic organizer to you for feedback before they complete the final letter.

Materials: Letter writing graphic organizer and check list (see appendix).

Assessment: A peer assessment in the form of a check list will be completed for the graphic organizer. This will be handed in together with the final letter after completion (Period 10).

Curriculum expectations addressed: 1.2 analyse the impact on society and the environment of extracting and refining rocks and minerals for human use, taking different perspectives into account 2.6 use a variety of forms to communicate with different audiences and for a variety of purposes.

Period 10: Completion of Final Letter to City Councillor

- Instruct students to use their graphic organizer and peer suggestions to write up a final letter to the City Councillor stating whether or not they support the proposed rock quarry.
- Hand out the Letter Assessment Rubric and go over it with the class.
- Provide time to complete the letter writing task. If time permits have peers edit the work and type up the final draft on the computer.

Materials: Letter writing graphic organizer (see appendix); computers if possible.

Reminder: Book computer lab if the final drafts are to be typed up on the computer.

Assessment: The students will be given a mark (out of 20 suggested) for their final letter using the assessment rubric.

Curriculum expectations addressed: 1.2 analyse the impact on society and the environment of extracting and refining rocks and minerals for human use, taking different perspectives into account 2.6 use a variety of forms to communicate with different audiences and for a variety of purposes.

Accommodations

- Students should be allowed extra time to complete tasks if they require it.
- English Language Learners should either have the handouts and worksheets translated or have someone that is able to help them understand the assignment.
- For the letter writing give students with learning disabilities or English Language Learners the option to orally demonstrate their knowledge to the teacher instead of writing it.
- Consider grouping strategies that will best help students with special needs.

Resources and Websites:

“Science Is...” by Susan V. Bosak. Published by Scholastic Canada Ltd.: Toronto (2000). ISBN: 0-590-74070-9.

www.rocksforkids.com (excellent site for background information on rock cycle, mineral identification, uses for rocks and minerals and mining and quarrying. Also great for students interested in rock collecting)

www.learner.org/interactives/rockcycle/index.html (interactive website on the rock cycle)

www.explorellearning.com (has a great Gizmo for teaching about mineral identification tests)

Appendices: Student Handouts and Assessment Tools

Appendix A: Rock Information Sheet

Appendix B: Rock Classification Key

Appendix C: Self Assessment of Group Work and Participation

Appendix D: Persuasive Letter Writing Graphic Organizer and Check List

Appendix E: Persuasive Letter Assessment Rubric

Appendix A: Rock Information Sheet

Instructions: Assign a number to each rock and fill out one Information Sheet per rock.

Group Number: _____ Rock Number: _____

Who brought in this rock? _____

Where was it found? _____

Description

Size (in cm): _____

Colour(s): _____

Lustre: _____

General appearance (include the shape and presence of layers, crystals or fossils): _____

Scratched by: Fingernail ☐ Penny ☐ Glass ☐ Iron Nail ☐

Approximate Mohs Hardness: _____

Classification

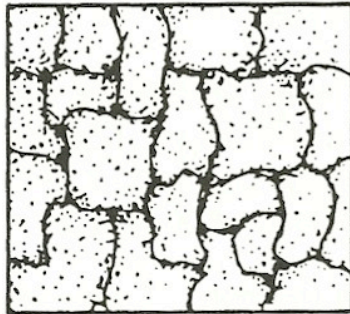
Use the Rock Classification Key to classify the rock as igneous, sedimentary, or metamorphic.

Explain your answer: _____

According to the rock cycle, how was this rock formed? _____

Appendix B: Rock Classification Key

1. a) Rock is made up of mineral grains that you can see → go to 2.
b) Rock is not made up of visible mineral grains → go to 5.
2. a) Rock is made up of mineral grains that look melted together (interlocked) → go to 3.
b) Rock is made up of mineral grains that look glued together (noninterlocked) → go to 6.
3. a) Mineral grains in the specimen all look to be the same kind → the rock is METAMORPHIC.
b) Mineral grains in the specimen are of two or more different types → go to 4.
4. a) Mineral grains in the specimen are *not* lined up; they are distributed in a random pattern, as shown in illustration A → the rock is IGNEOUS.
b) Mineral grains in the specimen are lined up; they show a definite arrangement or bonding, as shown in illustration B → the rock is METAMORPHIC.



A



B

5. a) Rock is either glassy or frothy (has small holes) → the rock is IGNEOUS.
b) Rock is made up of strong, flat sheets that look like they will split off into slate-like pieces → the rock is METAMORPHIC.
6. a) Rock is made of silt, sand, or pebbles cemented together; it may also have fossils → the rock is SEDIMENTARY.
b) Rock is *not* made of silt, sand, or pebbles but contains a substance that fizzes when vinegar is poured on → the rock is SEDIMENTARY.

Appendix C: Self Assessment of Group Work and Participation

Name: _____

Date: _____

Statement	I disagree strongly	I disagree	I agree	I agree strongly	Why I agree or disagree
I came prepared with my 2 rocks and helped my group complete the Rock Information Sheets					
I helped in the rock collection display and was happy with the final display					
I listened to others in my group and learned from them					

Overall I would give myself a mark of ____ out of 5.

What characteristic did your group use to sort your rock collection: _____

How does this characteristic relate to how these rocks might be used by the Rocks-R-Us company: _____

Appendix D: Persuasive Letter Writing Graphic Organizer and Check List

Name: _____

School Address: _____

Date: _____

Salutation: _____

Opening statement in favour of or opposed to the proposed rock quarry: _____

Reasons: _____

Concluding Statement: _____

Closing: _____

Checklist (to be completed by a classmate):

Name: _____

- ☐ All the parts are filled out
- ☐ The opening statement clearly states opinion for or against the proposed rock quarry
- ☐ At least three convincing reasons are given to support their position
- ☐ Concluding statement strongly re-states their opinion
- Suggestions: _____

Appendix E: Final Persuasive Letter Assessment Rubric

	Level 4	Level 3	Level 2	Level 1
Opening Statement	Strongly and clearly states opinion on proposed rock quarry	Clearly states an opinion on proposed rock quarry	Opinion on proposed rock quarry is not clearly stated	Opinion on proposed rock quarry is absent or hard to understand
Supporting Reasons *	Three or more excellent points are made with good support. Uses the pros and cons of mining as discussed in class.	Three or more points are made with support, but the arguments are somewhat weak. Some use of the pros and cons of mining as discussed in class.	Two or three points are made but the arguments are weak. Little reference to the pros and cons of mining as discussed in class.	Weak or missing arguments. No reference to the pros and cons of mining as discussed in class.
Format and Language	Letter is clear, well structured and well written. Good use of vocabulary such as minerals, safety and environment.	Letter is somewhat clear and structured. Some use of vocabulary such as minerals, safety and environment.	Letter is not very clear and poorly structured. Little use of vocabulary such as minerals, safety and environment.	Letter is unclear and poorly structured. No use of vocabulary such as minerals, safety and environment.
Concluding Statement	Summarizes personal opinion in a strong concluding statement.	Summarizes personal opinion in a concluding statement.	Concluding statement is a weak summary of personal opinion.	Concluding statement makes no reference to personal opinion.

* Extra weight given to Supporting Reasons